There is a paucity of literature investigating the extent to which human personality predicts lifetime (age-controlled) offspring. The present study contributes to this field in assessing whether the inter-related 'dark' personalities that have been linked to mating success (i.e., narcissism, Machiavellianism, and psychopathy: the 'Dark Triad') predict number of children. Analyses from an online sample (N = 314) revealed that for men, psychopathy was a negative predictor, and narcissism a positive predictor of lifetime offspring. For women, psychopathy emerged as a negative predictor of lifetime offspring. Results are discussed in respect of the importance of these traits to fitness-related outcomes, including reproduction, and the need to consider sex differences, as these traits may have a different function in men and women.

Keywords: Reproduction, Dark Triad, narcissism, Machiavellianism, psychopathy

Introduction

The Dark Triad is a trio of sub-clinical personality traits, encompassing narcissism, Machiavellianism, and psychopathy (Paulhus & Williams, 2002). These traits are moderately intercorrelated, and share a disagreeable, callous, and self-interested core, yet each also has unique defining aspects, correlates, and outcomes. Narcissism is defined by an exaggerated sense of self-importance and need for success in competition with others (Raskin & Terry, 1988). Machiavellianism is characterised by behavioural flexibility and the use of interpersonally manipulative and exploitative tactics (Christie & Geis, 1970). Psychopathy represents a cold, emotionless inter-personal orientation, coupled with a tendency for risk-taking, impulsive behaviour (Hare, Neumann, & Widiger, 2012).

Although historically considered to be maladaptive (e.g., McHoskey et al., 1999), evolutionary psychologists have articulated multiple ways in which the Dark Triad relate to beneficial mating outcomes. All three Dark Triad traits are associated with success in short-term mating (Jonason, Li, Webster, & Schmitt, 2009), which could be achieved via inter- or intra-sexual selection, or sexually-coercive strategies. Indeed, although individuals high in the Dark Triad are considered initially attractive (e.g., Aitken, Lyons, & Jonason, 2013; Jauk et al., 2016), it is well-documented that they also engage in coercive and exploitative mating (Blinkhorn, Lyons, & Almond, 2015; Holtzman & Strube, 2012; Jonason, et al., 2009; Jones & Olderbak, 2014; Muñoz, Khan, & Cordwell, 2011). Further, the Dark Triad is also associated with higher degrees of intra-sexual competition for mates (Brewer & Abell, 2015a; Carter, Montenaro, Linney, & Campbell, 2015) and mate poaching (Jonason, Li, & Buss, 2010). The elevated interest in short-term

mating and the use of diverse mating tactics should, theoretically, have a positive impact on reproductive success.

However, relatively little work has addressed the extent to which manipulative attitudes and behaviour translate into increased lifetime offspring. Ample empirical evidence in non-human animals suggests that boldness and aggression, especially in males, has a positive correlation with fitness (e.g., Smith & Blumstein, 2008). In humans, high extraversion (Alvergne, Jokela, & Lummaa, 2010; Jokela, Alvergne, Pollet, & Lummaa, 2011), delinquency (Wei, Loeber, & Stouthamer-Loeber, 2002), and leadership (Jokela & Keltikangas-Jarvinen, 2009) have a positive relationship with number of children. This suggests that traits that are associated with status-seeking and risk-taking may correlate with number of lifetime offspring. The Dark Triad is characterised by boldness, aggression (Jones & Paulhus, 2010), and increased search for status and power (Lee et al., 2013), hence these traits may also have an association with increased fitness as measured by the number of offspring.

Much of the research on the Dark Triad has focussed on reproductive success as measured by the number of matings, reflecting that individuals high in these traits prioritise mating over parenting effort (Jonason, Valentine, Li, & Harbeson, 2011). However, to our knowledge, there are few studies investigating the Dark Triad in relation to actual number of offspring produced, something that we intend to address in the present study. One exception is a study by Međedović, Petrović, Želeskov-Đorić, and Savić (2017), who investigated psychopathy and reproductive success in a sample of male prisoners in Serbia. They found that the "lifestyle" (i.e., impulsive, irresponsible) facet of psychopathy had a relationship with having fewer offspring, and interpersonal-

facet (i.e., manipulation and dishonesty) was associated with an increased number of children. Interestingly, the interpersonal facet has also been suggested to be part of "successful psychopathy", which could facilitate an evolutionarily adaptive cheater strategy (Lyons, 2015). However, Međedović et al. (2017) also found that another aspect of successful psychopathy (i.e., affective) had a negative correlation with the number of children. Thus, at least in a sample of Serbian prisoners, the associations between psychopathy and the number of offspring is related to different facets of psychopathy in a very specific manner.

Another relevant study looked at outpatients at a personality disorder unit in Spain, and found no association between the number of children and psychopathy-like traits (antagonism, asociality, impulsive sensation seeking; Vall et al., 2016). This study would imply that the impulsivity aspect of psychopathy is not a relevant factor in determining reproductive success. However, the participants for these two studies come from forensic and clinical settings, which may not be generalizable to other populations (e.g., student or community samples). Thus, these confusing findings could be partially due to sample characteristics. It would be beneficial to extend the research to non-incarcerated, non-clinical populations, using all three Dark Triad measurements simultaneously to control for the shared variance between the traits.

With regards to narcissism and Machiavellianism, we are not aware of any studies that have looked at the offspring number of people high in these traits. Narcissism seems to be the most adaptive trait in the Dark Triad constellation, demonstrated by an association with increased self-reported physical and mental health (Jonason, Baughman, Carter, & Parker, 2014), physical attractiveness (Holtzman & Strube, 2010), and higher

current and childhood socio-economic status (Jonason, Icho, & Ireland, 2016). Further, using a facial morphing methodology, Marcinkowska, Lyons, and Helle (2016) demonstrated that those women who had a higher number of children had also an increased preference for high narcissistic facial morphs. It is possible that having offspring with narcissistic men is beneficial to women's reproductive success, and supports the idea that narcissism serves an adaptive function for men in relation to mating (e.g., Holtzman & Strube, 2012). Thus, we would expect that narcissism has a positive relationship with offspring number, especially in men. Machiavellianism, in turn, has been associated with a more cautious approach to short-term mating (e.g., Jones & de Roos, 2017). If short-term mating orientation is a reasonable proxy for the number of children produced, we would expect that Machiavellianism has either no association, or has a negative association with the number of children.

In summary, the present study adds to the existing literature by investigating the association between the Dark Triad traits and self-reported number of children in a community sample of heterosexual male and female participants. This study is important in terms of looking at the actual number of children, rather than proxies for reproductive success (e.g., mating interests) that have been used in previous studies. We hope to highlight the possible adaptive functions of the Dark Triad in both sexes, rather than focussing on the traits as "male mating adaptations" (Jonason et al., 2009). On the bases of previous research on short-term mating orientation, we would expect that psychopathy and narcissism are associated with higher number of offspring, and Machiavellianism is either negatively related, or has no association with the number of children.

Method

Participants, materials, and procedure

Following ethical approval, we recruited 314 heterosexual participants (174 men), primarily from the United Kingdom, United States, and Canada (95%), via advertisement on participant-recruitment websites and snowball sampling. Participant age ranged from 18-69 years (M_{AGE} = 35.04; *SD* = 11.18). We asked participants whether they were partnered (*n* = 170), single (*n* = 142), or other (*n* = 2), and their socio-economic status (SES) based on their annual income before tax (grouped into ten categories, varying between 1 = less than £10 000 and 10 = more than £100 000).

Following demographic questions (as above), participants were asked "how many children do you have?", which was used as an outcome variable in the analyses. Number ranged from 0 – 4 children (*M* = .56, *SD* = .97). Participants then completed the Short Dark Triad (SD3) inventory (Jones & Paulhus, 2014). The SD3 assesses each of the Dark Triad traits across three nine-item subscales. Participants respond on a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*) to statements including "I insist on getting the respect I deserve" (narcissism), "Make sure your plans benefit you, not others" (Machiavellianism), and "People who mess with me always regret it" (psychopathy). Items were averaged to create indices of narcissism (Cronbach's α = .80), Machiavellianism (α = .65), and psychopathy (α = .83). Participants were subsequently debriefed, and thanked for their time.

Data analysis

Data were first explored with cross-correlational analyses separately for each sex. This was followed by step-wise linear multiple regression analyses, where the number of offspring was entered as the outcome variable. We entered SES, age, and relationship

status as predictor variables at Step 1, and the three Dark Triad traits as predictors at Step 2. We decided to add SES, age, and relationship status as control variables in regression analyses, as they each had a significant relationship with number of offspring (SES r = .19, $p < .001$; age $r = .54$, $p < .001$; relationship status F (2, 311) = 11.92, $p < .001$; We created dummy variables for the categorical variable of relationship status, where 1 = in a relationship (n = 170), and 0 = single or other (n = 144).

Results

Men scored higher for each of the Dark Triad traits, in keeping with existing findings (e.g., Jonason et al., 2009). There was no significant difference for lifetime offspring between the sexes. Descriptive statistics and sex differences are provided in Table 1.

Table 1

Descriptive statistics and sex differences for Dark Triad traits and lifetime offspring

	M (SD)			*t*	*d*
	Overall	Women	Men		
	(*N* = 314)	(*n* = 140)	(*n* = 174)		
Narcissism	2.67 (.75)	2.43 (.75)	2.87 (.69)	5.32**	.61
Machiavellianism	3.09 (.57)	3.00 (.57)	3.12 (.57)	2.36*	.20
Psychopathy	2.38 (.78)	2.19 (.94)	2.54 (.72)	4.08**	.42
Lifetime offspring	.56 (.97)	.66 (1.00)	.48 (.94)	-1.70	.18

Note. ** $p < .001$, *$p < .05$

To calculate the relationship between the Dark Triad traits and lifetime offspring, we conducted a series of correlation and regression analyses. Analyses were undertaken separately for men and women. Relationships between the Dark Triad lifetime offspring are presented in Table 2, which shows the Pearson's cross-correlations and standardised regression coefficients (controlling for age, SES, relationship status, and the shared variance between the Dark Triad variables).

Table 2

Pearson correlations and standardised regression coefficients for Dark Triad traits and lifetime offspring

	r (β)		
Lifetime offspring	Narcissism	Machiavellianism	Psychopathy
Men	.10 (.27**)	.03 (.03)	-.30** (-.16*)
Women	-.31** (.01)	-.11 (.09)	-.42** (-.26*)

Note. * $p < .01$, ** $p < .001$. The Beta coefficients are based on regressions where the age, SES, relationship status, and the two other Dark Triad variables are controlled for.

The cross-correlations indicate that psychopathy has an inverse association with number of children in both sexes, and narcissism had an association with fewer children

158 in women. The correlation co-efficients were significantly different between the sexes
159 only for narcissism and the number of children (Fisher's $z = 3.67$, $p < .001$).
160 For the regression analyses, we first entered age, SES, and dummy-coded
161 relationship status variable, followed by the three Dark Triad variables. For women, the
162 model was significant at Step 1, where age, SES, and relationship status collectively
163 explained 26% of the variance in the number of children (F (3, 136) = 17.30, $p < .001$).
164 Age ($\beta = .48$, $t = 6.58$, $p < .001$) and relationship status ($\beta = .17$, $t = 2.36$, $p < .01$) were
165 both positive predictors for the number of children in women. At Step 2, the model was
166 still significant (F (6, 133) = 9.95, $p < .001$), with all the variables predicting 31% of the
167 variance in number of children. The Dark Triad variables added only 3.4% to the
168 variance at Step 2, with psychopathy emerging as a significant negative predictor ($\beta = -$
169 .26, $t = 2.40$, $p < .01$). At Step 2, age ($\beta = .35$, $t = 3.70$, $p < .01$) and relationship status ((β
170 = -.17, $t = 2.39$, $p < .01$) remained as significant predictors.
171 For men, the model was significant at Step 1, where age, SES, and relationship
172 status collectively explained 40% of the variance in the number of children (F (3, 170) =
173 37.81, $p < .001$). Age ($\beta = .53$, $t = 8.88$, $p < .001$), SES ($\beta = .22$, $t = 3.65$, $p < .001$), and
174 relationship status ($\beta = .13$, $t = 2.08$, $p < .05$) were all positive predictors for the number
175 of children in men. At Step 2, the model was still significant (F (6, 167) = 23.25, $p <$
176 .001), with all the variables predicting 46% of the variance in number of children. The
177 Dark Triad variables added 6% to the variance at Step 2, with narcissism as a significant
178 positive ($\beta = .27$, $t = 3.97$, $p < .01$), and psychopathy as a significant negative ($\beta = -.16$, t
179 = -2.19, $p < .01$) predictor. Age ($\beta = .55$, $t = 8.50$, $p < .01$), SES ($\beta = .15$, $t = 2.43$, $p <$

.02), and relationship status (β = .12, t = 1.97, p < .05) remained significant predictors in Step 2.

Discussion

Previous research has suggested that the Dark Triad evolved as a mating adaptation (e.g., Carter et al., 2015; Jonason et al., 2009). However, rather than investigating the actual number of offspring produced, most studies have utilised sexual behaviour and attitudes as a proxy for reproductive success. In this brief survey, we investigated the relationship between the Dark Triad of personality, and an important reproductive outcome variable: the number of children an individual has. We found that narcissism in men was a positive predictor, and psychopathy in both sexes was a negative predictor of self-reported number of offspring. The results are intriguing, suggesting that any reproductive benefits of the Dark Triad may be localised to narcissism, and only in men. Despite mating-oriented behaviours in high Dark Triad individuals, the three traits are not equally adaptive when it comes to measuring a crucial reproductive currency, the number of children.

The results for narcissism are in line with theoretical literature suggesting that narcissism serves an adaptive function for men in relation to mating (e.g., Holtzman & Strube, 2012). In the contemporary Western world, narcissism is associated with higher socio-economic class (Jonason et al., 2016; Piff, 2014), and higher class is related to greater number of children, but only in men (Hopcroft, 2015). Women may be able to increase their reproductive success by choosing high-status (Bereczkei & Csanaky, 1996) and high-narcissistic (Marcinkowska et al., 2016) partners. Thus, the positive association between male narcissism and number of children could be due to women's choice for

higher-status mates for both partnerships and extra-marital affairs (see also Von Rueden, Gurven & Kaplan, 2010 for evidence in a small-scale society).

The finding that psychopathy had a relationship with fewer children in both sexes concurs with recent finding from a study on prisoners in Serbia (Međedović et al., 2017). These results contradict the notion that psychopathy is adaptive as a personality trait promoting a fast life history strategy (Jonason, Koening, & Tost, 2010). Psychopathy in women is related to sexual health (including miscarriages and pain during sex), suggesting that the trait may have more costs and fewer benefits for women (Jonason & Lavertu, 2017). It is possible that poor sexual health explains the link between psychopathy and a reduced number of children in women. Further, psychopathy is linked to risky sexual behaviour in both sexes (Kastner & Sellbom, 2012), including lower likelihood of condom use (Fulton, Marcus, & Payne, 2010; Jonason et al., 2015), and higher incidence of sexually-transmitted diseases (Beaver et al., 2014), which, in turn, reduces fertility (Apari, de Sousa, & Müller, 2014). It is possible that the costs of risky sexual behaviour in psychopathy outweigh the benefits, casting doubt over the idea that psychopathy is an adaptive trait promoting a fast life history strategy, at least in large-scale societies (see also Gladden, Figueredo, & Jacobs, 2009). In industrial societies with widespread access to contraceptives, it is of course difficult to separate proximate and ultimate relationships (Pérusse. 1993) and additional research in traditional populations is required.

In the present study, Machiavellianism did not relate to number of offspring for either sex. The emotional detachment and cynicism which characterise Machiavellianism (Christie & Geis, 1970) may suggest a reluctance to produce children. Susceptibility to

infidelity and engagement in sexual behaviour for physical pleasure or to attain a goal, etc. (each related to Machiavellianism) may, however, increase opportunities for reproduction (Brewer & Abell, 2015b). The strategic and exploitative nature of Machiavellianism may result in children only where the costs and benefits can be managed. For example, those high on Machiavellianism may be more likely to produce children if this confers status and reduces the stigma associated with childlessness. Those high on Machiavellianism may be particularly encouraged to reproduce if their partner or extended family provide substantial resources and support.

In terms of limitations, we used the SD3, a short-form measure of Dark Triad, which has been criticised for failing to capture some facets of the Dark Triad traits, such as vulnerable narcissism (Maples, Lamkin, & Miller, 2014). Future work could use longer-form measures of the traits, in order to allow investigation of theoretically relevant sub-components of narcissism and psychopathy. Second, we do not differentiate between planned and non-planned pregnancies (Berg, Rotkirch, Vaisanen, & Jokela, 2013) and include data from one parent only. Future research may obtain a more detailed record of participant reproductive histories and examine dyadic predictors of offspring number (Hutteman, Bleidorn, Penke, & Denissen, 2013). Third, most of our participants were from Western, Educated, Industrialised, Rich and Democratic countries (i.e., WEIRD; Henrich, Heine, & Norenzayan, 2010). Previous research has found differential correlates between extraversion and number of children in women in pre-industrial (Alvergne et al., 2010) and industrialised (Jokela et al., 2011) societies, demonstrating that the fitness consequences of personality traits could be highly context-specific. For instance, the prevalence of sexually-transmitted diseases is lower in small-scale, traditional societies

(Ohenjo et al., 2006), and it is possible that the benefits of promiscuous mating may outweigh the costs in these circumstances. Thus, the association between psychopathy and number of offspring could be different in small-scale communities than in large, more anonymous societies.

Despite these limitations, our findings are important for a number of reasons. Firstly, they pertain to a discernable, critical measurement of reproductive success: age-adjusted number of offspring, previously considered in relation to one Dark Triad trait only. The findings also support previous research which has found that the outcomes associated with the Dark Triad vary by sex (Jonason, Lyons, Bethell & Ross, 2013; Lyons et al., 2017) and trait (Paulhus & Williams, 2002). Research on the Dark Triad is advancing at an exponential rate (Marcus & Zeigler-Hill, 2015), yet relatively little work has been undertaken in areas such as this. Increasingly, researchers are emphasising the importance of these traits from an evolutionary perspective. The present study joins formative work on issues including longevity, and health-related behaviours (Hudek-Knežević, Kardum, & Mehić, 2016; Jonason et al., 2015; Jonason et al., 2010).

Finally, we hope we have drawn attention to the need to both explore and explain how the Dark Triad functions in different ways for males and females. The traits do not function identically across sex: research has identified instances of comparable outcomes related to mating (e.g., Jonason, Lyons, & Jones, 2013) but also cases where these differ (e.g., Lyons & Rice, 2014). In respect of the current finding, though none of the Dark Triad predicted increased lifetime offspring for women, there may be other factors that we were not able to directly assess. Hence future research should consider offspring quality and longer term reproductive success as measured by number of grandchildren

(Berg, Lummaa, Lahdenpera, Rotkirch, & Jokela, 2014). Good genes, acquired from a short-term partner, may represent a functional trade-off for women for a lack of investment, and also contribute to reproductive success (Fisher, 1915; Gangestad, 1993; Li & Kenrick, 2006). Given existing knowledge about highly-narcissistic women's sexual competitiveness (Carter et al., 2015) and women's relatively high demand for mate quality (compared with men's) in short-term mating (Jonason et al., 2011), this might explain how high levels of the Dark Triad traits function for women characterised by them. Future work should continue to consider and study this issue.

In conclusion, the present study reinforced earlier work (Lynn, 1995; Međedović et al., 2017) regarding 'dark' personality and reproductive output. We specifically identified narcissism as a positive predictor of offspring in men, suggesting that narcissism could have evolutionary roots as a male mating adaptation (Holztman & Strube, 2012). Psychopathy emerged as a negative predictor of offspring for both sexes, casting doubt over the adaptiveness of the trait in modern populations. Rather than using promiscuous mating in Western populations as a proxy for reproductive success, future research should focus on outcomes such as the number and quality of children and the generations beyond.

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